

# Audio Delay Lines

## BALANCED AND UNBALANCED

| Model | Total Delay      | Tol. | Max. Freq. for Delay Tolerance | Attenuation | VSWR   | Impedance (Ohms) | 3 db Bandwidth | Dimensions (inches)  |
|-------|------------------|------|--------------------------------|-------------|--------|------------------|----------------|--|
| F135A | 74.56 $\mu$ sec  | 1%   | 20,000 cps                     | 1.0 db      | 1.0 db | 1170             | 5 Kc/s         | 4 x 2.31 x 1.31  |
| F330  | 61.20 $\mu$ sec  | 1%   | 15,000 cps                     | 0.5 db      | 0.5 db | 1100             | 25 Kc/s        | 4 x 2.31 x 1.31  |
| F344  | 74.60 $\mu$ sec  | 1%   | 15,000 cps                     | 0.5 db      | 0.5 db | 1170             | 25 Kc/s        | 4 x 2.31 x 1.31  |
| F416  | 1700 $\mu$ sec   | 1%   | 4,000 cps                      | 3.0 db      | 1.0 db | 1000             | 6 Kc/s         | 10 x 5 x 5   |
| F437  | 208 $\mu$ sec    | 1%   | 5,000 cps                      | 0.5 db      | 0.5 db | 680              | 29 Kc/s        | 5 x 4.5 x 1.25   |
| F444  | 98.736 $\mu$ sec | 1%   | 15,000 cps                     | 0.5 db      | 0.5 db | 1170             | 25 Kc/s        | 4 x 2.31 x 1.31  |
| F483  | 1000 $\mu$ sec   | 1%   | 10,000 cps                     | 3.0 db      | 0.5 db | 600              | 15 Kc/s        | 19 x 3 $\frac{1}{2}$ x 5 $\frac{1}{2}$<br>Relay Rack Mounting  |
| FA784 | 5000 $\mu$ sec   | 1%   | 12,000 cps                     | 12 db       | 1 db   | 600              | 5 Kc/s         | 19 x 5 $\frac{1}{4}$ x 13 $\frac{1}{2}$<br>Relay Rack Mounting |

- **DELAY** ..... to 25,000 microseconds
- **FREQUENCY** ..... 5 cps to 100,000 cps
- **IMPEDANCE** ..... to 10,000 ohms



- **VERY LONG DELAY TIME**
- **LOW ATTENUATION**
- **EXCELLENT PHASE LINEARITY**

## LONG DELAYS

| Specifications                              |         | 25 Millisec Delay<br>FA-573/25T | 100 Millisec Delay<br>FA-573/100T |
|---|---------|---------------------------------|-----------------------------------|
| Overall Delay                               |         | 25 millisec                     | 100 millisec                      |
| Characteristic Impedance                    |         | 1000 ohms                       | 1000 ohms                         |
| Number of Taps                              |         | 25                              | 100                               |
| Delay Between Taps                          |         | 1 millisec $\pm$ 1/2%           | 1 millisec $\pm$ 1/2%             |
| Attenuation $\leftarrow$                    | 10 cps  | 2 db                            | 8 db                              |
|   | 100 cps | 2.6 db                          | 10.4 db                           |
|   | 300 cps | 5.5 db                          | 22.0 db                           |
| Bandwidth                                   |         | 400 cps                         | 400 cps                           |
| Phase Linearity                             |         | $\pm$ .75% up to 300 cps        | $\pm$ .75% up to 300 cps          |
| Size — Standard Retma Rack Cabinet Mounting |         | 19" x 5 $\frac{1}{4}$ " x 10"   | 19" x 21" x 10"                   |
| Weight                                      |         | 50 lb.                          | 200 lb.                           |



**CONTROL ELECTRONICS COMPANY, INC.**

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

# High Frequency Delay Lines

Delay Lines for operation at frequencies up to 500 megacycles are now being developed and produced to meet special requirements. Control Electronics offers to fill your high frequency delay line requirements. We are able to fill all the environmental and tolerance specifications that are presently being met with our lumped constant delay lines at lower frequencies. These high frequency delay lines are available in fixed and variable types or can be tapped at various delay points. They are made to meet applicable military specifications.

Characteristics of delay lines, developed by Control Electronics, for high frequency application are shown in the following table.



**Model V215**  
125 Mc/s bandwidth

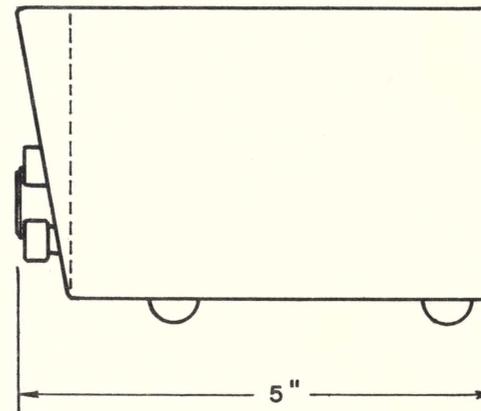
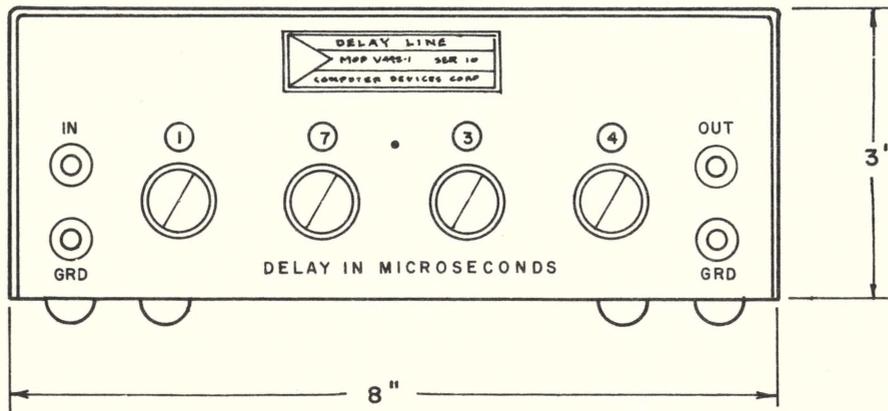
| Characteristic      | Model Number  |           |            |            |
|---------------------|---------------|-----------|------------|------------|
|                     | V215          | F258      | F264       | F272       |
| Time Delay          | 0 to 50 n sec | 10 n sec  | 50 n sec   | 200 n sec  |
| Rise Time           | —             | —         | 10 n sec   | 16 n sec   |
| Bandwidth           | 125 Mc/s      | 500 Mc/s  | 50 Mc/s    | 30 Mc/s    |
| Impedance           | 50 ohms       | 50 ohms   | 100 ohms   | 120 ohms   |
| Spurious            | < 5%          | < 3%      | < 3%       | < 3%       |
| Attenuation (Pulse) | < 5%          | < 1%      | < 5%       | < 10%      |
| Terminals           | BNC/Type N    | BNC       | WIRE LEADS | WIRE LEADS |
| Thermal Stability   | 50 PPM/°C     | 50 PPM/°C | 50 PPM/°C  | 50 PPM/°C  |

Model V215 was specifically developed for use by the Radio Astronomy Station of the Harvard College Observatory in its Star Tracking experiments. It is designed for continuous motor driven application and is constructed with a rugged, printed circuit, commutator type switch having rhodium plated segments and a silver alloy wiper arm. Resolution is one part in 120.



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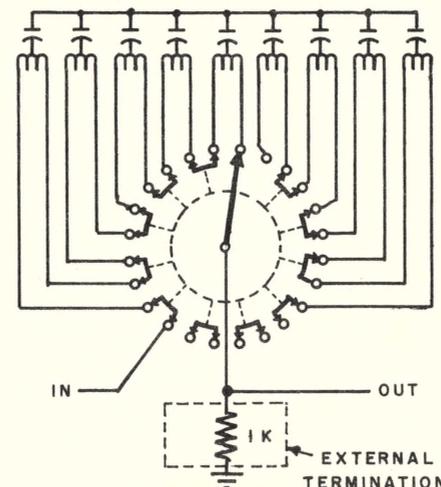


NOTES: EQUIPMENT HAS GRAY HAMMERTONE FINISH AND IS EQUIPPED WITH FOUR RUBBER FEET.

MULTI-PURPOSE BANANA PLUG RECEPTACLES PROVIDED FOR SIGNAL AND GROUND CONNECTIONS.

TABLE OF ELECTRICAL SPECIFICATIONS

| MODEL                                | V492<br>-1 | V492<br>-2 | V492<br>-3 | V492<br>-4 |
|--------------------------------------|------------|------------|------------|------------|
| DELAY RANGE<br>MICROSECONDS          | 0 19.99    | 0 29.99    | 0 9.99     | 0 99.99    |
| DELAY INCREMENTS<br>MICROSECONDS     | .01        | .01        | .01        | .01        |
| RISE TIME<br>MICROSEC. AT MAX. DELAY | 0.5        | 0.7        | 0.3        | 3.0        |
| IMPEDANCE<br>INPUT & OUTPUT (OHMS)   | 1000       | 1000       | 1000       | 1000       |
| ATTENUATION<br>DB MAX.               | 5          | 6          | 3          | 3          |
| DISTORTION                           | 10 %       | 10 %       | 10 %       | 10 %       |



SCHEMATIC  
DIAGRAM  
(SHOWING ONE SECTION)

MODEL V492-3 HAS THREE SECTIONS (SWITCHES)

ALL OTHER MODELS HAVE FOUR SECTIONS (SWITCHES) AS SHOWN ON OUTLINE DRAWING ABOVE.

DELAY LINE, VARIABLE,  
DIRECT READOUT  
(INSTRUMENT TYPE)  
MODEL V492

COMPUTER DEVICES  
CORP.

6 WEST 18-TH ST.  
HUNTINGTON STA., N.Y.

SCALE 1/2" = 1" DWN *Rock* 9/18/68  
APPVD *E.W.* CHKD *K. Duma*

A 49201  
SIZE DWG NO. REV.



# AUDIO DELAY COMPENSATION LINE



## DA 324

The DA 324 is a high performance audio frequency variable Delay Line designed specifically for use in data communications systems to compensate for delay shifts caused by unequal lengths of wire communication lines. The DA 324 has a delay of 400 microseconds with delay setting adjustable to any delay in this range in steps

of 1 microsecond.

The DA 324 also accepts a companion delay extension unit, the DA 324C with a delay of 600 microseconds, which is coupled directly to the controls of the DA 324, thus providing a combination having a total delay of 1000 usec adjustable in 1 usec steps.

| MODEL                       | DA 324                              | DA 324 & DA 324C Combined  |
|-----------------------------|-------------------------------------|----------------------------|
| Delay                       | 400 usec                            | 1000 usec                  |
| Resolution                  | 1 usec                              | 1 usec                     |
| Rise time at maximum delay  | 11 usec max                         | 12 usec max                |
| Input impedance             | 600 ohms                            | 600 ohms                   |
| Output impedance            | 600 ohms                            | 600 ohms                   |
| Voltage standing wave ratio | <.5 db to 30 kc                     | <.5 db to 27 kc            |
|                             | <3 db to 50 kc                      | <3 db to 45 kc             |
| Insertion loss              | 1 db max                            | 3 db max                   |
| Temperature stability       | 50 PPM/°c                           | 50 PPM/°c                  |
| Phase linearity             | <1/2%                               | <1/2%                      |
| Ripple or distortion        | <10% of Signal                      | <10% of Signal             |
| Size                        | 3 1/2 X 19 Rack<br>Panel X 10" Deep | 2 Panels same as<br>DA 324 |

The Delay setting is accomplished by three decade, insertion type switches with a numerical display reading directly in microseconds. These controls are normally mounted in the rear of the unit to forestall tampering, or as a front panel display.

When ordering specify:

1. Location of Controls — Front panel or rear of unit
2. Type of Controls — Knob or screwdriver slot
3. Location of Connectors — Front panel or rear of unit
4. Type of Connectors — BNC or binding posts

**COMPUTER DEVICES CORP.**

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# DELAY LINES FOR AUDIO FREQUENCIES



This series of lumped constant Delay Lines is specifically designed for use in the AUDIO and low frequency range (0 to 60 kilocycles). Special "M" section designs, high "Q" coils and temperature compensating capacitors are used to provide minimum phase distortion, low VSWR, low insertion loss and good temperature stability. They are particularly applicable to such sonic, sub-sonic and ultra-sonic uses as:

- ANALOG COMPUTERS
- AUTO CORRELATION
- SONAR
- SEISMIC WORK
- SONAR RANGING
- TELEPHONE LINE CORRECTION

| Type                   | Model  | Delay in $\mu$ s | Fco in Kcs | Z in Ohms | Insertion Loss db | Tap Delay or Step Delay | Size in inches    |
|------------------------|--------|------------------|------------|-----------|-------------------|-------------------------|-------------------|
| FIXED AND TAPPED DELAY | DA131  | 74.4             | 43         | 1200      | .5                | 4.65 $\mu$ s            | 4 x 2-1/4 x 1-1/4 |
|                        | DA158  | 208              | 50         | 680       | .7                | 4                       | 5 x 4-1/2 x 1-1/4 |
|                        | DA301  | 1000             | 40         | 600       | 3                 | 20                      | 19 x 3-1/2 x 9    |
|                        | DA261  | 5000             | 10         | 500       | 3                 | 40                      | 19 x 5-1/4 x 10   |
|                        | DA177  | 100000           | 0.4        | 1000      | 10                | 1000                    | 19 x 21 x 12      |
| VARIABLE DELAY         | AV175  | 0 to 150         | 60         | 500       | 6                 | .1                      | 9 x 3 x 6         |
|                        | AV206  | 0 to 1000        | 40         | 600       | 3                 | 1.0                     | 19 x 3-1/2 x 12   |
|                        | AV211  | 0 to 10000       | 5          | 600       | 3                 | .1                      | 19 x 5-1/4 x 15   |
|                        | AV287  | 0 to 500         | 40         | 1000      | 3                 | .002                    | 19 x 3-1/2 x 12   |
| BALANCED DELAY LINES   | DBA149 | 1000             | 7          | 600       | 1                 | 50                      | 19 x 1-3/4 x 5    |
|                        | DBA173 | 2000             | 7          | 600       | 2                 | 50                      | 19 x 3-1/2 x 5    |
|                        | DBA315 | 4000             | 7          | 600       | 4                 | 50                      | 19 x 7 x 5        |
|                        | DBA320 | 8000             | 7          | 600       | 8                 | 50                      | 19 x 7 x 9        |

- VSWR - Less than  $\pm 1/2$  db up to 50% of cut-off frequency
- PHASE LINEARITY - Less than  $\pm 1/4\%$  up to 50% of cut-off frequency
- TEMPERATURE STABILITY - Less than 40 PPM/ $^{\circ}$ C from  $-55^{\circ}$ C to  $+85^{\circ}$ C

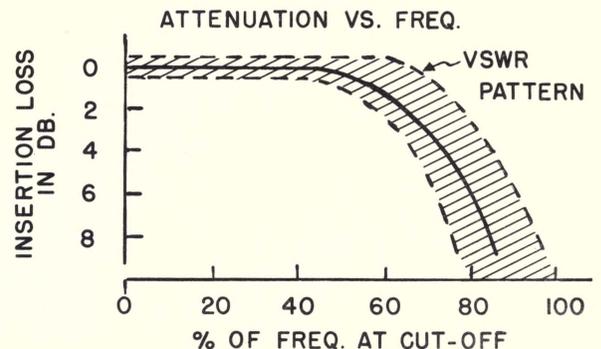
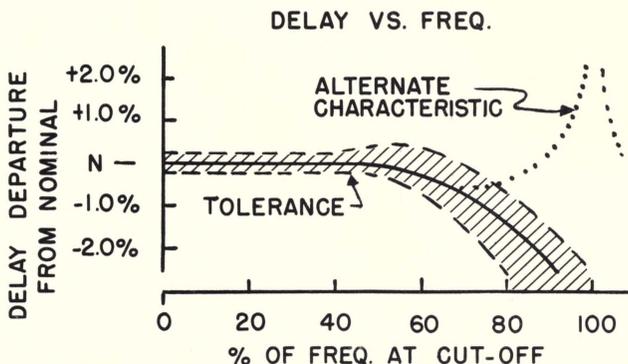
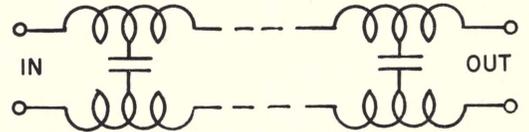
AUDIO DELAY LINES are generally custom made to meet a specific requirement. The above listing is indicative of the attainable characteristics. Variations of delay time, voltage standing wave ratio, frequency response, tap spacing, impedance, etc. are tailored to meet customers' specifications.

TAPPED DELAY LINES are manufactured with as many tap delay points as desired. The above listing suggests tap spacing that is economically available and a practical limit on tap spacing is about 1/10 of that shown.

DELAY ACCURACY: Standard accuracy on total delay and tap delay is 1% of delay and accuracies better than .1% are available.

VARIABLE DELAYS are supplied as a multi-control decade switch arrangement. The decades use the insertion principle and are ganged to provide any resolution required. Where very fine resolution is required, the fine control is accomplished with a continuously variable Delay Line, thus providing very high resolution of a very long delay. (See AV287 above.)

BALANCED DELAY LINES are designed specifically for time compensation of balanced ungrounded 600 ohm systems. They are particularly useful in telephone and voice transmission applications. The basic balanced Delay Line circuit is:



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All CDC Delay Lines are manufactured to meet the rugged Mil specs for ship - land - aircraft and missile equipment.